

*A COMPARISON OF PROCEDURES FOR  
ELIMINATING SELF-INJURIOUS BEHAVIOR OF  
RETARDED ADOLESCENTS<sup>1</sup>*

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An attempt was made to eliminate the self-injurious behaviors of four institutionalized, profoundly retarded adolescents. Some of the behaviors studied were: face-slapping, face-banging, hair-pulling, face-scratching, and finger-biting. Three remedial approaches to self-injurious behavior were compared. Elimination of all social consequences of the self-injurious behavior was not effective with the two subjects with whom it was attempted. The same two subjects were exposed to a procedure involving reinforcement of non-self-injurious behavior which was ineffective under no food deprivation and was effective with one of the two subjects under mild food deprivation. Electric-shock punishment eliminated the self-injurious behaviors of all four subjects with whom it was attempted. The results suggested that punishment was more effective than differential reinforcement of non-self-injurious behavior which, in turn, was more effective than extinction through elimination of social consequences. However, the effects of the punishment were usually specific to the setting in which it was administered. In order to eliminate the self-injurious behaviors of severely retarded children, it is apparently necessary to carry out the treatment in many of the settings in which it occurs.

Self-injurious behavior by children has been reported since before the turn of the century (Hall, 1899; Goodenough, 1931; Isaacs, 1937; Nunberg, 1948; Cain, 1961; Lovaas, Freitag, Gold, and Kassorla, 1965; Lovaas and Simmons, 1969). Early explanations were derived mostly from psychoanalytic theory. Fenichel (1945, p. 365) suggested a relationship between self-injurious behavior and the *archaic biological reflex of autonomy*, a reflex producing abandonment of an injured organ for a substitute organ to be regenerated. Ferenczi (1956, p. 105) interpreted these behaviors as manifestations of a death wish. Spitz (1953) attributed self-injurious behavior to the guilt of children in whom superego functioning had developed (about 18 months of age). Spitz theorized that development of self-injurious

behavior that took place before that psychosexual stage was a product of *anacletic depression*.

More recently, a behavioral analysis of self-injurious behavior has emerged that has focused on procedures for modifying the behavior. For example, Ferster (1961) suggested that social reinforcement may sometimes be responsible for maintaining self-injurious behavior and that elimination of the social consequences for self-injurious behavior might reduce its frequency. A second method of reducing self-injurious behavior has been suggested by Lovaas, *et al.*, (1965). They reported the almost complete elimination of self-injurious behavior by the differential reinforcement of another behavior. A third remedial method that has been offered is punishment. Tate and Baroff (1966), Risley (1968), and Lovaas and Simmons (1969) have described the complete suppression of self-injurious behavior by the application of electric shock contingent upon the behavior.

The present research compared the effects of the behavioral treatments described above, *i.e.*, elimination of social consequences, differential reinforcement of other behavior, and punishment of the self-injurious behavior of institutionalized retardates.

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## GENERAL METHOD

### *Subjects*

Four profoundly retarded, adolescent residents of a state institution were originally referred by the cottage staff. All subjects had been continuously institutionalized for at least 10 yr. Each was either considered untestable or had scored below the lower normative extremes on the standardized intelligence tests attempted with them. Their social quotients on the Vineland Social Maturity Scale were all below 15 and their ages ranged between 17 and 20 yr at the time of the experiment. Reports of their self-injurious behavior had occurred for at least 4 yr. According to their psychological reports, retardation had occurred as a result of structural brain damage, Down's syndrome, maternal intoxication, and post-natal infection respectively.

Since relatively long baselines were to be recorded, the first two subjects were selected partly because their less severe self-injurious behaviors could occur over a period of time without producing serious physical damage. This factor was weighed less heavily in the selection of the last two subjects, due to the fact that only the procedure that was expected to be most effective would be administered. Other selective dimensions were, (1) the presence of a relatively high stable rate of self-injurious behavior and, (2) self-injurious topographies that could be measured with a high degree of inter-observer reliability. Five potential subjects were discarded on the basis of these criteria.

### *Apparatus*

Part of the study was carried out in two small rooms in the Research Training Laboratory at Parsons State Hospital and Training Center. One room, "Room A", was trapezoidal in shape with two right angles, one acute angle, and one obtuse angle. The lengths of the sides were approximately 6, 9, 7, and 3.5 ft. The other room, "Room B", was rectangular, approximately 5 by 4.5 ft. The rest of the study was conducted in the subjects' living cottages. In the laboratory, the subjects were seen at the same time each day. Sessions in the cottages were held at irregular times.

Except when reliability data were gathered, push-button, pocket-sized counters were used to record responses. Grason-Stadler schedul-

ing equipment and hand-operated switches were used to examine inter-observer agreement.

Two electric shock devices were employed. Inductarium A was a hand-built prod attached to the end of a 10-ft extension cord. This produced 150 v at approximately five milliamps. Use of this unit was restricted to areas where an electrical outlet was within the reach of the 10-ft cord. Inductarium B was a modified electrical prod manufactured by Hot Shot Products. This prod had been designed so that voltage from the five flashlight batteries was stepped up and discharged to the prod end. The prod was modified to lower its output to approximately 300 v at one milliamp. When possible, the shock was administered to the arm involved in the self-injurious behavior. This was not always possible because Subjects 3 and 4 resisted being shocked. Consequently, shock was sometimes applied to the other arm.

### *Ethical Consideration*

The calculated application of painful stimuli, albeit without injury, always involves important ethical consideration. This is compounded when the recipient is a severely retarded child. Accordingly, modification techniques were planned with Subjects 1 and 2 in a manner to minimize the necessity of inducing pain. Sequential treatments involving increments in subject discomfort were applied until self-injurious behavior was attenuated. Withdrawal of social consequences was instated initially and (in the absence of reduced self-injurious behavior) was to be followed by the reinforcement of incompatible behavior. In turn, if these procedures were unsuccessful, shock punishment was to be applied.

The ethical issues raised by Subjects 1 and 2 were quite different from those with Subjects 3 and 4. The former exhibited mild forms of self-injury and the consequences of ineffective treatment efforts were not extreme. Greater physical injury was likely with Subjects 3 and 4. With them, the dominant ethical consideration was one of applying the form of treatment with the greatest potential effectiveness at the earliest possible time. Accordingly, shock punishment was the first form of treatment attempted with the latter two subjects.

These research guidelines were developed in cooperation with the institution's Committee on Research Ethics.

### *Response Definitions*

Subject 1 had been observed to slap himself repeatedly so that his cheeks were usually red and bruised. The response definition given to observers was: "a response is to be counted with this subject each time the palm of either hand comes into contact with his face".

Subject 2 had been observed to emit the following self-injurious responses: (1) slapping her face with various parts of her hand; (2) poking her eye with her thumb; (3) poking her tongue with her thumbnail; and (4) hitting her face against the floor or against a chair. These behaviors frequently resulted in bruising and occasionally in bleeding. Two response definitions were developed for this subjects' behavior; one that would produce a high level of inter-observer reliability while the second response definition was aimed at measuring the severity of the self-injurious response, perhaps at a lesser level of inter-observer agreement. The following response definitions were given to the observers:

1. "Any contact between any part of the head and any part of the hand or of a solid object (including the floor and chairs) is to be counted. Each contact will be counted as one response. If the subject breaks contact with one part of her hand while maintaining such with another part of the same hand, no new responses will be counted regardless of how many more times the subject hits herself. However, if the subject maintains contact with one hand while hitting herself with the other hand or with a solid object, a new response is to be counted. If the subject hits herself with both hands at the same time, two responses will be counted unless both hands are clasped together."
2. "Any response that the observer thinks would hurt him (or her), if he (or she) were emitting it, providing that the response is being counted under the previous definition."

The second response measure was taken only in Room A and only during the baseline period.

Subject 3 usually wore mittens on her hands and seemed to make no attempt to take them off. However, when the mittens were removed by someone else, she was observed to pluck out small strands of her hair and to pull pieces of skin off the sides of her face with her fingernails. The subject was invariably observed to have little hair on her head and many fresh, bleeding wounds on the sides of her face. Even though there appeared to be two different classes of responses, no effort was made to measure each one individually. The following response definition was given to the observers: "a response is to be counted every time that the subject picks at her face, hurting herself, or removes any of her hair".

Subject 4's index fingers were approximately 70% wider at the knuckles than at the base of the cuticle. The fingers of 10 other similarly developed children from the same cottage were measured and found to be between 10% and 20% wider at the knuckle. Psychological evaluations written more than 4 yr before the start of the study referred to constant chewing on her fingers and an "inability to discriminate edible from non-edible substances", evidenced by attempts to eat anything that she was physically capable of ingesting. The psychological reports interpreted this oral behavior as "tension releasing" and noted that her breathing rate was higher when she did not have anything in her mouth than when she did. On the basis of those reports and the experimenter's preliminary observations, the following response definition was given to the observers: "a response is to be counted each time that the subject introduces anything not edible into her mouth, including parts of her hand".

### *Measurement Reliability*

In some laboratory sessions, when no contingency was being applied, inter-observer reliability data were gathered. The senior author (at the time, a clinical psychologist), was always one of two independent observers, while the second observer role was rotated among three other individuals (another clinical psychologist, a research psychologist, and a research assistant). Each observer had a concealed push-button hand switch which, when closed, sent a pulse to its counter. It was arranged so that there was no auditory feedback to the observers from the switches or

counter apparatus. The sessions in which reliability was measured were automatically divided into eight segments of equal duration. A measure of inter-observer agreement was obtained by correlating counts in successive segments. Measures of inter-observer agreement were also obtained during some of the laboratory sessions in which a contingency was being applied. However, the observations were not independent because one observer could see the other applying the contingency. The reliability data from these sessions, therefore, are somewhat difficult to evaluate. Finally, reliability data were obtained in the cottage by the senior author and by ward aides. This was generally accomplished by independent writing of responses for each recording period, the senior author making a hand signal to indicate a new period. The one exception was with the reliability of data of Subject 1. This was checked by the aide saying "now" whenever she saw the subject emitting the response and the senior author determining if he heard the "now" within 1 sec of his own observation of the response.

#### *Experimental Design*

Multiple baseline experimental designs (Baer, Wolf, and Risley, 1968) were used under the punishment conditions with each subject. When using this experimental design, two or more baselines of the same behavior were recorded simultaneously under different conditions such as in different rooms or with different people in the presence of the subject. The treatment was then introduced for one of the baselines but not for the second. The second baseline acted as a control for coincidence being responsible for any change in the first baseline. The second baseline allowed estimation of how the treated baseline might have looked if the treatment had not been applied. A second replication of the effect with the second baseline also served to increase confidence in the reliability of the treatment effect.

### SPECIFIC PROCEDURES AND RESULTS

#### *Elimination of Social Consequences*

Subjects 1 and 2 were observed 1 hr a day each for 12 consecutive days in Room A through a one-way mirror. No social stimula-

tion was available. No decrement in either subject's rate of self-injurious behavior was noted.

#### *Differential Reinforcement of Other Behavior (DRO)*

This procedure was applied to Subjects 1 and 2. All sessions lasted 15 min. No contingencies were applied during each subject's first 14 sessions, which were used as baseline.

For the next 10 sessions, the subjects were given a bite of food for any behavior other than the self-injurious response. These sessions were conducted without food deprivation. Each session began with the experimenter standing in the center of Room A holding a paper cup containing varied candies. The subject sat in a corner. The experimenter moved slowly toward the subject and, provided that the subject had not emitted the response within the previous 15 sec, placed a piece of candy in the subject's mouth. After the candy had been delivered, the experimenter quickly moved back to the center of the room and the 15-sec interval began again. If the subject emitted the self-injurious response, the experimenter quickly moved to the wall opposite the subject where he remained immobile for 15 sec. Following this, the experimenter moved toward the subject at a pace that placed him at the center of the room in 15 sec. At the center of the room, a new 15-sec "trial" was initiated. In effect, the subject received a piece of candy every 15 sec as long as he (or she) had not emitted the target response but had to wait 45 sec after emitting a self-injurious response.

In an attempt to enhance the effectiveness of the food as a reinforcer, the above procedure was continued for 25 more sessions with Subject 1 and for 10 more sessions with Subject 2 with two changes; (1) the reinforcer became a thick malt spoon-fed to the subject (one teaspoonful per reinforcement) and (2) lunch was withheld on the days that experimental sessions were conducted. Subject 1's sessions were conducted at approximately 3:00 p.m. and Subject 2's at 4:00 p.m. During this condition, experimental sessions occurred on alternate days in order to maintain appropriate nutritional standards for the subjects.

Subject 1 showed no decrease in rate when candy was used as a reinforcer during no deprivation. When the reinforcer was changed

to the thick malt and deprivation was instituted, the rate declined rapidly from a median of 20 responses per session during baseline and 22 responses during the no-deprivation procedure to zero for the 25 deprivation sessions. Responses occurred in only three of the last 23 sessions.

During Sessions 12, 13, and 14 of baseline and Session 17 of the condition where other behavior was reinforced under deprivation, inter-observer agreement was measured. The agreement was 100%, 100%, and 98% for the three baseline sessions. Both observers agreed that no responses occurred during Session 17 when other behavior was being reinforced. In addition, each observer was asked to estimate the percentage of the subject's responses that should be considered "hard slaps". One observer estimated 90% and the other 95%.

Subject 2 showed little, if any, change in the rate of her self-injurious responses under either of the conditions, no-deprivation with candy, or deprivation with malt. Her median rate of response was 158 during baseline, 135 during reinforcement of other behavior without deprivation, and 156 during reinforcement of other behavior under deprivation. Inter-observer agreement was measured during Sessions 11, 12, and 14 of the baseline. Agreements of 99%, 99%, and 98%, respectively were obtained.

### Multiple Schedule

Since Subject 1 showed a decrease in rate when the reinforcer was changed and deprivation was instituted, multiple schedule comparisons were then directed with this subject toward the effects of deprivation operations and the influence of the contingency in scheduling food delivery. The subject participated in two 15-min sessions each day, first in Room A and then in Room B.

The conditions in Room A were the same as before (*i.e.*, a teaspoon full of thick malt was presented for other behavior). In Room B, the subject was fed a teaspoon full of the malt every 15 sec regardless of his behavior; otherwise, the treatment was identical to that in Room A. The subject continued to miss his lunch on alternate days while daily sessions were held. This arrangement assured the completion of a four-component multiple schedule every two days. The four conditions were as follows: (1) reinforcement of other behavior

with deprivation; (2) reinforcement of other behavior with *no* deprivation; (3) non-contingent food with deprivation; and (4) non-contingent food with *no* deprivation. A total of 28 sessions, seven for each condition, occurred under this schedule.

As Fig. 1 shows, the lowest rates occurred under deprivation. The rate under this condition was most often zero. The highest rates occurred during the no deprivation with non-contingent food condition, which resulted in a median rate of 35 responses per session. The no deprivation with reinforcement of other behavior condition, and the deprivation with non-contingent food condition yielded median rates of 16 and 19 responses per session, respectively. Inter-observer agreement for the last session of the deprivation with non-contingent food condition was 100%. Two independent observers agreed that there were no responses during the last deprivation with reinforcement of other behavior session.

### Punishment (Study I)

Subject 1 was observed during two 15-min sessions each day for seven days. One session was held in Room A and the second in the cottage. Occasionally, when the session was scheduled to begin in the cottage, the subject was found on the floor with his eyes closed. The session would then be postponed for an hour or more.

For seven days, following the baseline period, shock was applied with Inductrium A following each self-injurious response during the sessions in Room A but was not applied in the cottage. Shock was then applied with

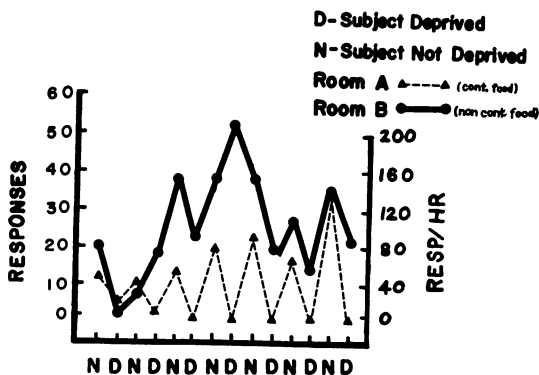


Fig. 1. Total number of hand-to-face responses emitted by Subject 1 during the Multiple Schedule phase.

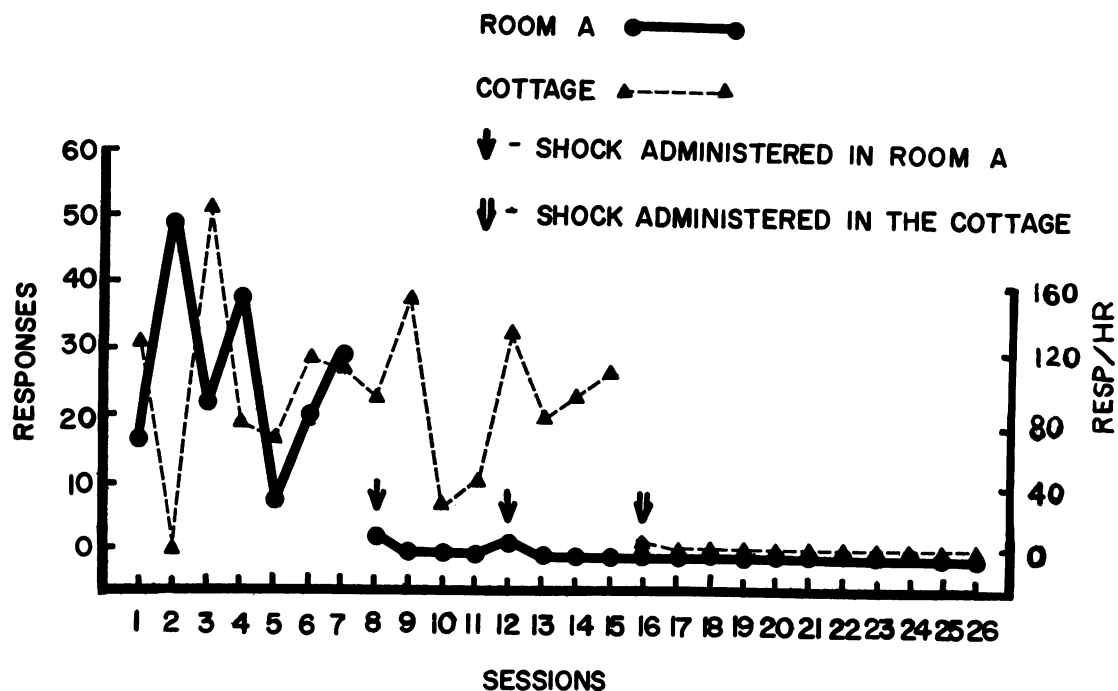


Fig. 2. Total number of hand-to-face responses emitted by Subject 1 during Punishment (Study 1).

Inductarium B in the cottage as well for 10 sessions.

The median number of responses per 15-min session during the seven days of baseline was 22 at the laboratory and 28 at the cottage. While shock was being applied only in the laboratory, the number of responses in the laboratory exceeded zero in only the first (two responses) and the fifth (one response) sessions. The median number of responses observed during the cottage sessions during the same seven days was 23. As Fig. 2 indicates, the response did not recur in either cottage or laboratory following the first cottage administration of shock. Inter-observer agreement was measured during the fourth cottage session. The senior author counted 19 responses and the aid said "now" within approximately 1 sec on each of these occasions.

#### *Punishment (Study 2)*

Following the procedure involving reinforcement of other behavior for Subject 2, baseline conditions were reinstated for two sessions in Room A. After those sessions, the subject started receiving contingent shock, administered via Inductarium A.

After the first session of shock in Room A,

15-min baseline sessions in Room B preceded the daily shock sessions in Room A. During Session 10, Inductarium A was placed in Room B so that it was clearly visible to the subject. The same procedure was repeated in Sessions 12, 14, and 16.

Starting on the fifteenth day of this treatment, a third baseline of 15-min sessions was begun at the cottage. Subject 2 was often found lying down in the cottage with her eyes closed. As with Subject 1, the observation session was postponed for at least 1 hr on these occasions. In Session 18, shock with Inductarium A was introduced in Room B.

Figure 3 shows that there was an immediate decrease to near-zero response rates first in Room A and then in Room B as the shock was successively introduced.

The two baseline sessions yielded rates of 121 and 102 responses per session, respectively. The count dropped to 14 on the first day of shock in Room A and to two responses or fewer in the same room thereafter. In 14 of the first 22 sessions in Room A, the rate was zero.

While zero or near-zero rates were exhibited in Room A, 68 to 194 responses per session (a median of 146 responses) were

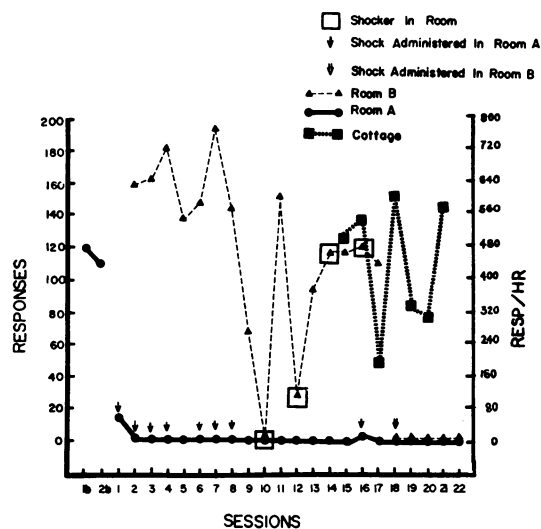


Fig. 3. Total number of face-hitting responses emitted by Subject 2 during Punishment (Study 2).

emitted in Room B for the next eight days in the absence of treatment. The response rates exhibited in Room B were 0, 149, and 28 when Inductarium A was shown to the subject, removed, and reintroduced in Sessions 10, 11, and 12, respectively. Subsequent display of the Inductarium in Room B (Sessions 14 and 16) did not have a marked effect. During the same five sessions, only one response (Session 16) occurred in Room A. The number of responses in Room B decreased to one in Session 18 when the shock was first introduced in that room. Subsequent rates in Room B were all at zero levels.

The seven session cottage baseline, established during Sessions 15 through 21, yielded a median of 127 responses per session. Inter-observer agreement was measured in the cottage in Session 18 and in Rooms A and B during Session 19. Agreement in the cottage was 99%. Complete inter-observer agreement occurred in Rooms A and B; no responses were recorded by either of the observers.

#### *Punishment (Study 3)*

After Subject 2 had exhibited zero rates of self-injurious behavior in Rooms A and B, observations in Room B were discontinued and another multiple baseline experimental design was employed in the cottage. Four different observers initiated 15-min observation periods in the cottage at different times, applying contingent shock with Inductarium B in a sequen-

tial series. The schedule was arranged so that at least 1 hr intervened between different observers in the cottage. When the subject was found lying down with her eyes closed, sessions were rescheduled to a time compatible with the other observers' schedules. Increasing familiarity with the subject's sleeping habits minimized the number of sessions rescheduled on this basis.

Unfortunately, it was usually impossible to schedule all four observers on the same day. As many as possible were scheduled on those days when each observer first began to apply shock. The first shock delivery by a given observer always preceded other observations scheduled for that day. This permitted the assessment of any effects of generalization to other observers. In addition, after only one observer (Observer 1) had applied shock in the cottage, shock was temporarily discontinued in order to assess the durability of the effect. As soon as the response reappeared, shock was reintroduced.

Figure 4 indicates that there was little, if any, generalization after Observers 1 and 2 had applied their initial administration of shock. An unpunished rate decrement to zero was noted, however, in the presence of Observer 3, following Observer 4's initial shock administration. Observer 3 was unable to continue observations after the one session in which the rate of the unpunished behavior was zero. When Observer 1 temporarily discontinued the application of shock, the rate remained at zero for two sessions and recovered to 11 responses in the third non-shock session. Another shock session was then instated in which two responses occurred and were punished. Thereafter, the rate remained at zero in the presence of Observer 1. The rate of self-injurious behavior in Room A remained at zero throughout this study.

Near the end of the procedure described above, 15-min "hidden" observations were begun in the cottage. These observations were all taken by Observer 4, the senior author and the only one who had administered shock in Rooms A and B in the laboratory. During this phase, the observer made an effort to prevent the subject detecting his presence in the cottage (walking behind her back, hiding behind pieces of furniture, etc.). Observations in which the observer or the aides suspected that the subject had noted his presence

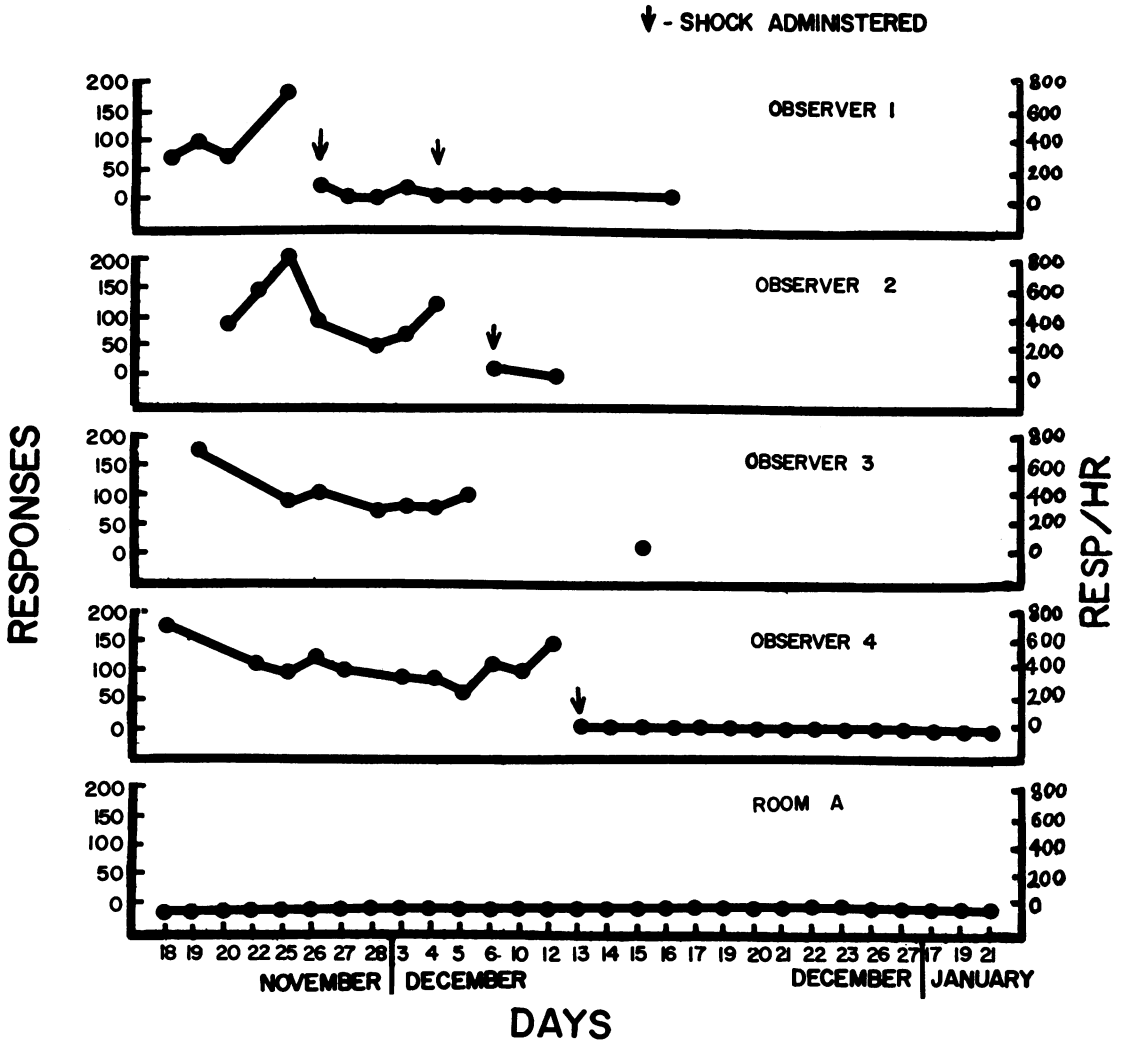


Fig. 4. Total number of face-hitting responses emitted by Subject 2 in the presence of Observers 1 through 4 during Punishment (Study 3).

were discarded. The criterion for "suspecting" detection was somewhat subjective. If the subject's face was, in the observer's or aide's opinion, at any time directed at the observer or at a point separated from the observer by an angle smaller than approximately  $90^\circ$ , the observation was discarded. Hidden observations were always taken between 7:00 a.m. and 9:00 p.m. with as many as six observations on some days and no observations on other days.

As shown in Fig. 5, the rate of self-injurious behavior under the "hidden" observations remained high even when the rate had declined to zero during "seen" observations. In the

fourth session after shock was administered during the regular "seen" observations, shock was administered during a "hidden" observation. This was accomplished by the experimenter leaving the hiding place, running to the subject, and administering the shock with Inductarium B. Forty additional hidden observations were taken with shock being administered on each occurrence of the response. During Sessions 32 and 35, inter-observer reliability was checked. Both the experimenter and an aide agreed on the occurrence of zero responses during each session. The most meaningful data from the hidden observations are those showing a rate of zero, since one re-



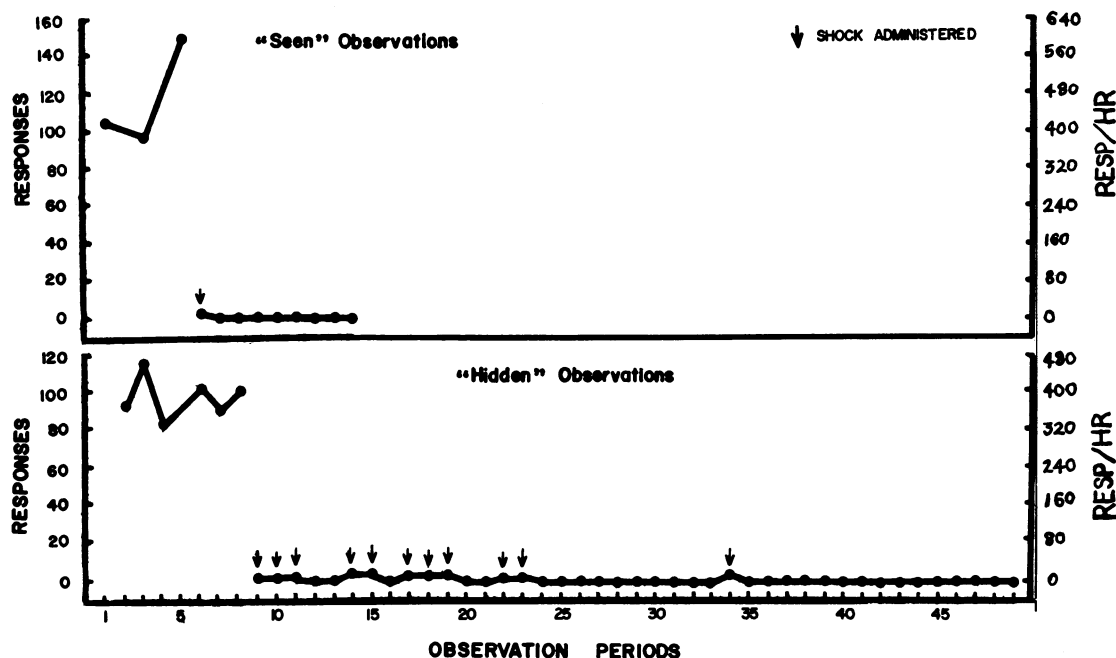


Fig. 5. Total number of face-hitting responses emitted by Subject 2 in the presence of Observer 4 during the "hidden" and "seen" observations.

sponse entailed revealing the observer's presence during the delivery of shock.

Since, by definition, the "more severe responses" were included in the broader response category that was brought to zero or near-zero rates, these responses were also eliminated. However, only during baseline were these responses measured. The number of "more severe responses" during the 14 baseline sessions fluctuated between 18 and 41 responses per session, with a median number of 26. Independent observer agreement was measured during Session 4 and found to be, surprisingly, almost as high as with the broader definition. Inter-observer agreement was 97%.

#### *Punishment (Study 4)*

This study was performed with Subject 3. Due to the severity and potential physical damage of this subject's behavior, sessions in this part of the experiment were limited to 5 min. Multiple baselines were taken in Room A and in the cottage.

During the eleventh session, shock contingent on each response was applied in Room A while baseline observations continued in the cottage. This arrangement was main-

tained through Session 19. Inductarium A was used for approximately the first 4.5 min of Session 11; Inductarium B was used for the last 30 sec of Session 11 and for Sessions 12 through 19.

After nine days of treatment in Room A and 19 days of no treatment in the cottage, the subject was shocked contingent upon the response once in the cottage during Session 20. Removal of the mittens constituted a discriminative stimulus so that it was impossible to take "hidden" observations without some alteration of the mitten arrangement. Accordingly, the mittens were removed permanently after the fourth cottage session of contingent shock and hidden observations were begun. A total of 17 hidden observations were taken after the mittens were permanently removed. These hidden observations were spaced over a period of 26 days. In general, two observations were taken during each three-day period. The same precautions to minimize subject detection of the observer's presence were applied to Subject 3 as with Subject 2. Figure 6 shows the course of behavior noted with Subject 3.

During baseline, the rate in Room A fluctuated between eight and 48 responses per 5-

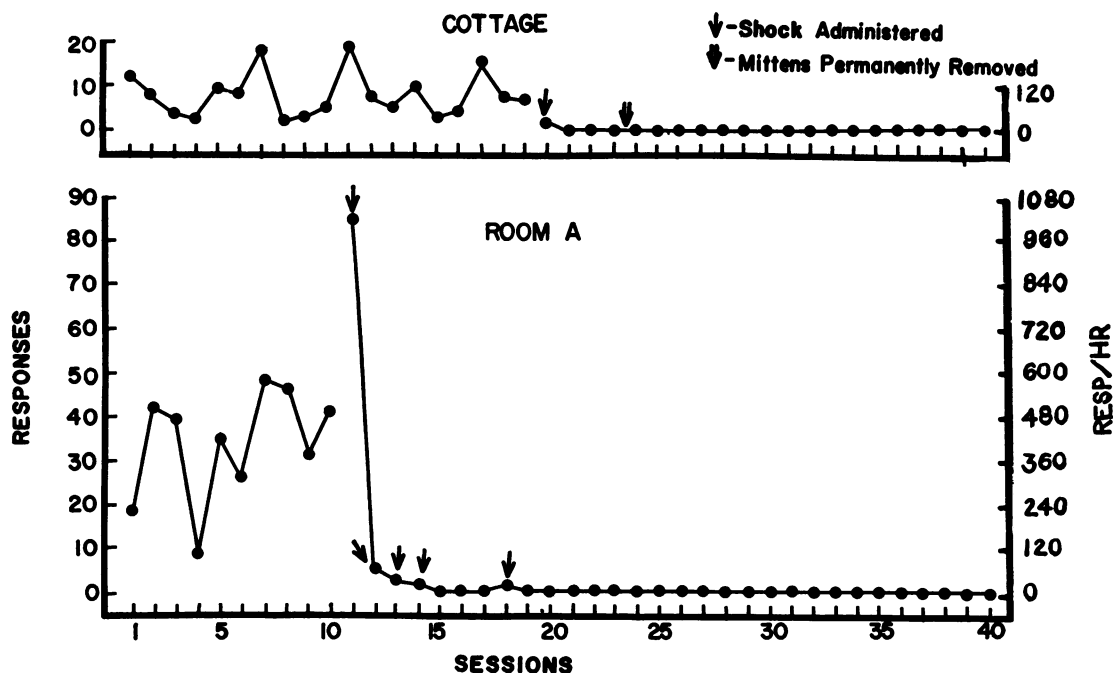


Fig. 6. Total number of face-scratching and hair-pulling responses emitted by Subject 3.

min session with a median of 36 responses while the rate of the behavior in the cottage was considerably lower, varying between two and 18 responses with a median of six responses. One aide suggested that Subject A exhibited self-destructive behavior primarily "when she is upset". Further questioning indicated "upsets" to be essentially correlated with change in her regular routine. Since placement in a novel environment with strangers would seem to be a definite change from the regular routine, this may account for the higher baseline rates observed in the laboratory.

On the day that shock was first introduced in Room A, the rate increased markedly, with 84 responses occurring in approximately 4.5 min of Session 11. This increase in the rate prompted substitution of Inductarium B for Inductarium A because the former delivered higher wattage and subjectively "felt" more aversive to the experimenter. With the punishment of only a single response via Inductarium B, no more responses occurred in the remaining 30 sec of the session. The response rates obtained on the next three days were six, three, and two, respectively. Thereafter, the behavior recurred in Room A only on one occasion. On the same days that the rate was

decreasing in the laboratory (Sessions 12 through 14), observations at the cottage revealed no decrement. During the first nine days of laboratory treatment, the cottage rate of response fluctuated between three and 19 with a median of seven responses.

In the first session of treatment in the cottage (Session 20), the punishment was administered once. The response did not recur in the remainder of that or the next three sessions.

At the time that the mittens were removed permanently, the experimenter planned to instate frequent hidden observations with the contingency applied from the beginning. Somewhat unexpectedly, however, the subject did not emit any responses during the 17 hidden observations.

It should be noted that even though the last 17 observations were hidden, it was suspected that the subject might have detected the experimenter's presence on three other occasions and the data for those sessions were discarded. Moreover, on several other occasions, the subject observed the experimenter monitoring the behavior of Subject 2 who resided in the same cottage.

Observer agreement of 100% and 98% was obtained for Sessions 4 and 6 in Room A and

observer agreement of 100% was obtained in the cottage for Sessions 2 and 9. Agreement on the occurrence of zero responses was obtained in Room A during Sessions 28 and 31.

### *Punishment (Study 5)*

A multiple baseline of 15-min observations was begun in Room A and in the cottage. No contingencies were applied during the first six days. This part of the cottage baseline included only five observations, since cottage observations were not initiated until the second day.

An accident occurred at the onset of laboratory Session 7, the day after the above-mentioned observations. The subject touched the prod attachment of Inductrium A, which had been inadvertently left on in the laboratory after working with another subject. Ten more sessions of baseline in each setting were taken, affording a total of 16 sessions in Room A and 15 in the cottage. In the laboratory the shock was administered with Inductrium B contingent on every self-injurious response. This was introduced in Session 17 and continued for 23 additional sessions, while baseline observations were continued at the cottage.

Subject 4's total number of responses for

each cottage and laboratory session is presented in Fig. 7.

During the 16 laboratory sessions of baseline, not including the session that the subject received the accidental non-contingent shock, the number of responses per session ranged between 12 and 47, with a median of 29 responses. On the day that the subject received the non-contingent shock, 123 responses occurred. Subject 4's self-injurious behavior increased to 109 responses during the first day of contingent shock. A rapid decrease in subsequent sessions followed this initial increase. A rate of zero was achieved by Session 25. One punished response appeared in Session 27, followed by 12 more sessions with a rate of zero. The behavior in the cottage was unaltered following administration of contingent shock in Room A. For the 15 cottage sessions before contingent shock in the laboratory, the number of responses per session fluctuated between 14 and 59, with a median of 25. For the 24 cottage sessions that followed the first laboratory administration of contingent shock, the rate fluctuated between 11 and 48 responses per session, with a median of 28.

Inter-observer agreement in the laboratory was measured during Sessions 10 and 14 and found to be 99% and 100%. Inter-observer

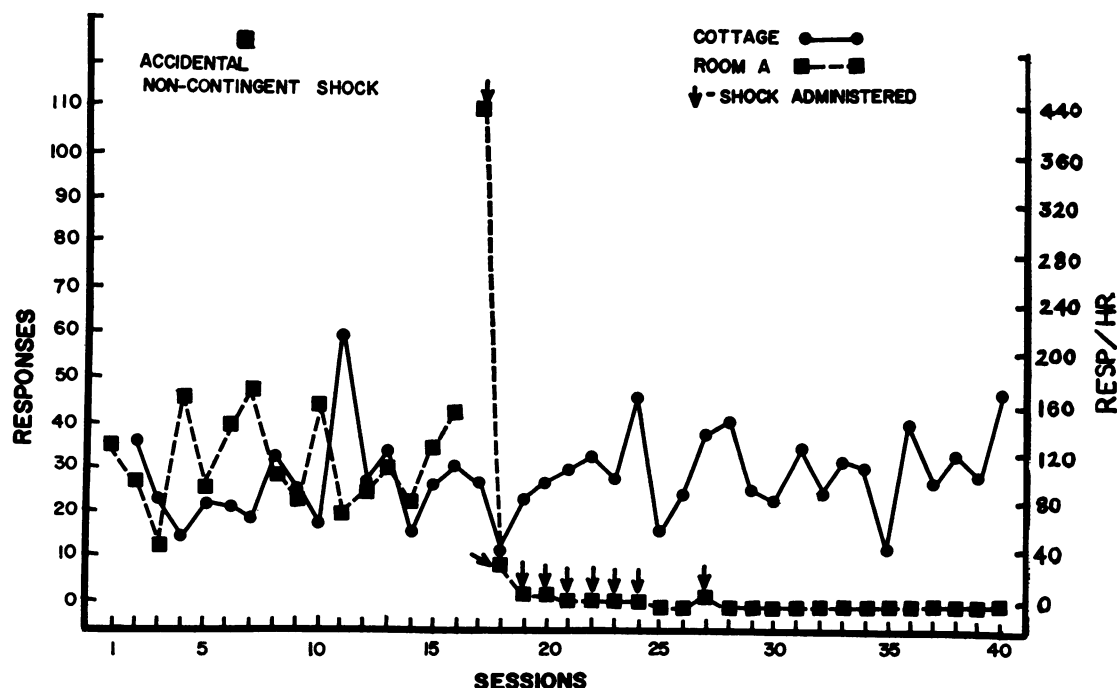


Fig. 7. Total number of hand or object-in-mouth responses submitted by Subject 4.

agreement in the cottage was measured during Sessions 10, 16, and 34 and found to be 88%, 99%, and 99%, respectively. Reliability was also assessed in Room A during Session 27; both observers agreed that only one response occurred and that it occurred during the third period.

It would have been desirable to apply the treatment to the behavior in the cottage with Subject 4, but administrative difficulties precluded additional treatment.

### DISCUSSION

Shock punishment was effective in decreasing the rate of self-injurious behavior to zero or near-zero levels with all four subjects. These results confirm the findings of other investigators (Tate and Baroff, 1966; Risley, 1968; Lovaas and Simmons, 1969). However, as Risley (1968), Birnbrauer (1968), and Lovaas and Simmons (1969) have noted, the effects of the punishment were highly specific and discriminated. On the other hand, generalization did appear to occur in the present study under certain conditions. One instance is reflected in the data obtained with Subject 2. This subject's rate of self-injurious behavior decreased in the presence of a fourth observer without shock, after shock was administered by three other observers. This demonstration of programmed generalization has important implications. Apparently, after punishment by three adults, the subject spontaneously generalized to the fourth adult. On the other hand, the subject still did not spontaneously generalize to those occasions when no observers were in view. Thus, it was necessary to schedule further generalization of punishment effects during the sessions involving "hidden" observations. The highly specific and discriminated nature of the effects of the punishment demonstrates that profoundly retarded children can make discriminations when strong consequences are applied. For example, Subject 2 was found to discriminate between different rooms in the laboratory and between those rooms and her cottage, as well as between four different adults. Discriminating between different adults is a skill not generally attributed to such intellectually deficient subjects. The considerable specificity of the punishment effects has important practical implications. Treatment of self-injurious behavior with punishment must include the

active generalization of the effects through a planned program of treating the behavior under as many different conditions as necessary to produce a generalized effect.

There seems to be another possible problem in shock punishment. Azrin (1960) reported recovery of the suppressed behavior during continued punishment. After repeated application of the punishing shock, the subjects appeared to adapt to the shock and the punished response recovered. Birnbrauer (1968) also reported an example of recovery after continued punishment in an applied setting. The present procedure may have minimized this problem by "sequencing" the presentation of shock in different situations. The suppression was initially achieved for only a few minutes a day. Only after this initial suppression had been accomplished and the number of shocks necessary to maintain continued suppression in the initial setting was very small, was suppression attempted in another situation. Suppression in each new situation required relatively fewer shocks. In spite of the fact that the procedure was not directly compared to one where the behavior was initially punished in all situations, it is quite possible that the "sequencing" reduced the total number of shocks necessary to suppress the behavior and, therefore, the probability of adaptation to the shock might have been decreased.

The role of the actual punishment *contingency* was not analyzed, *i.e.*, it was not demonstrated that contingent shock was responsible for the reduction in rate. It is possible, for example, that presenting the shock at times other than after the self-injurious responses would have decreased the behavior. Thus, no conclusion is possible about the necessity of the shock being *contingent* in order to be effective. Control periods of non-contingent shock application would have been necessary to clarify this point. However, with the ethical issues raised by the application of shock, even when contingent on a highly undesirable response, it was decided that control periods of non-contingent shock would not be appropriate. Despite this limitation, there seems to be little doubt about the effectiveness of the procedure. Clearly, contingent shock was sufficient to eliminate the behavior whether or not the contingency involved was actually necessary.

The permanence of the effects of punishment on self-injurious behavior is still open to question. With at least one subject the effects of punishment disappeared in the cottage setting two months after the procedure was discontinued. However, with this subject, no recovery was evident in the laboratory setting. It could be that for some self-injurious behaviors, periodic re-treatment would be a necessary but effective follow-up in a comprehensive treatment program.

The elimination of social consequences was not effective in reducing self-injurious behavior after 12 one-hour sessions. This conclusion is consistent with that of Lovaas and Simmons (1969). Even though they achieved extinction, considerably more than 12 hr were required. Furthermore, these authors concluded that extinction was not an advisable procedure due to the physical damage undergone by their subjects during the long process.

Food, presented after a lapse of time without the self-injurious behavior having occurred, was effective in reducing the response rate of only one of two subjects, and then only under mild food deprivation. The practicality of this procedure was an issue. The maintenance of a moderate state of food deprivation probably would not have been very easily carried out under ward conditions. Also, the small number of ward personnel that were available would probably have required that the reinforcers be given only in a very intermittent manner. Thus, the usefulness of the procedure under ward conditions seemed very questionable.

A feature of the response definitions should be considered. The definitions involved responses that were not necessarily self-injurious. The hand-to-face contacts of Subjects 1 and 2 and the hand-in-mouth responses of Subject 4 undoubtedly included responses that were not detrimental. However, the physical damage that was apparent for each subject indicated that at least some of the responses included by the definition were self-injurious. It might have been desirable to have restricted the definition to the more injurious responses. However, reliability of observations was considered of prime importance and the definitions that had the greatest potential for yielding reliable measures were used. Definitions designed to include only clearly self-injurious responses seemed more

subjective and thus possibly less reliable than the very broad and seemingly more reliable definitions used. It was felt that the less reliable definitions might have allowed some responses to go unpunished and thus suppression might have been achieved less rapidly. As it turned out, the reliability data indicated that the seemingly more subjective definitions produced almost as much agreement between observers as the broader definitions.

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